

## CLAIMS

What is claimed is:

1           1.     A method for identifying a bitloading assignment for a multicarrier  
2     communication channel having a number of sub-channels, a maximum capacity  
3     assignment, and a disposable bit capacity of one or more bits, the method comprising:  
4             identifying a sub-channel having a maximum bit loading relative to bit  
5             loadings of other sub-channels;  
6             decrementing the bit loading of the identified sub-channel by at least one bit  
7             thereby reducing bit loading differences between the identified sub-  
8             channel and the other sub-channels;  
9             decrementing the disposable bit capacity by the number of bits the identified  
10            sub-channel loading was decremented; and  
11            repeating the identifying step and the decrementing steps until a desired degree  
12            of equalization between the sub-channel bit loadings is achieved  
13            thereby producing a bitloading assignment for the multicarrier  
14            communication channel.

1           2.     The method of claim 1, wherein the steps are carried out by a set of codes  
2     or instructions executed by a processor included in a transceiver of the multicarrier  
3     communication system.

1           3.     The method of claim 1, wherein in response to a number of sub-channels  
2     having the same maximum bit loading, the identifying step further includes:  
3             selecting one of the sub-channels having the same maximum bit loading based  
4             on a predefined selection scheme.

1           4.     The method of claim 1, wherein the number of bits by which the identified  
2     sub-channel loading is decremented depends on at least one of the number of sub-  
3     channels of the multicarrier communication channel, the disposable bit capacity of the

4 multicarrier communication channel, and a bitmap associated with the multicarrier  
5 communication channel.

1 5. The method of claim 1, further comprising:

2 transmitting the bitloading assignment to a remote transceiver operatively  
3 coupled to the multicarrier communication channel thereby allowing  
4 the remote transceiver to use the bitloading assignment in performing  
5 bitloading.

1 6. The method of claim 1, wherein the desired degree of equalization  
2 between the sub-channel bit loadings is achieved when the disposable bit capacity is zero.

1 7. The method of claim 1, wherein the bitloading assignment produced by  
2 the method desensitizes the multicarrier communication channel to non-stationary noise.

1 8. The method of claim 1, wherein the multicarrier communication channel  
2 is realized with an ADSL Annex C transceiver pair coupled to one another via a  
3 transmission line.

1 9. The method of claim 1, wherein the multicarrier communication channel  
2 is effectively two different channels, one being a FEXT time channel and the other being  
3 a NEXT time channel, each effective channel having a unique maximum capacity  
4 assignment upon which the method operates thereby producing a first bitloading  
5 assignment for the FEXT channel and a second bitloading assignment for the NEXT  
6 channel.

1 10. The method of claim 1, wherein the maximum capacity assignment of the  
2 multicarrier communication channel is derived from a bitmap prepared during a  
3 bitloading training session.

1 11. The method of claim 1, wherein the maximum capacity assignment of the  
2 multicarrier communication channel is in the form of a bit vector upon which the method  
3 operates.

1           12.    A method for identifying a bitloading assignment for a multicarrier  
2 communication channel having a number of sub-channels, the method comprising:  
3           calculating a maximum number of bits that can be transmitted by each sub-  
4           channel;  
5           rounding the maximum number of bits that can be transmitted by each sub-  
6           channel to the nearest whole bit;  
7           calculating the maximum number of bits that can be transmitted by the  
8           multicarrier communication channel based on the rounded maximum  
9           number of bits that can be transmitted by each sub-channel;  
10          determining a target load of the multicarrier communication channel thereby  
11          defining a disposable bit capacity representing a delta value between  
12          the maximum number of bits that can be transmitted by the multicarrier  
13          communication channel and the target load of the multicarrier  
14          communication channel;  
15          identifying a maximum loaded sub-channel;  
16          decrementing the maximum loaded sub-channel by at least one bit;  
17          decrementing the delta value; and  
18          repeating the identifying step and the decrementing steps until the delta value  
19          is zero thereby producing a bitloading assignment that desensitizes the  
20          multicarrier communication channel to non-stationary noise.

1           13.    The method of claim 12, wherein the maximum number of bits that can be  
2 transmitted by each sub-channel, and the maximum number of bits that can be  
3 transmitted by the multicarrier communication channel are derived from a bitmap  
4 resulting from a bitloading training sequence, the bitmap characterizing the signal to  
5 noise ratio of the multicarrier communication channel.

1           14.    The method of claim 12, wherein the target load of the multicarrier  
2 communication channel is based on system configuration options.

1           15.     The method of claim 12, wherein the multicarrier communication channel  
2 is realized using digital multi-tone modulation.

1           16.     The method of claim 12, wherein in response to identifying more than one  
2 maximum loaded sub-channel thereby requiring a selection to be made, the method  
3 further includes:

4                 calculating a round off error for each sub-channel; and

5                 selecting the maximum loaded sub-channel having the greatest round off error.

1           17.     The method of claim 12, wherein in response to identifying more than one  
2 maximum loaded sub-channel thereby requiring a selection to be made, the method  
3 further includes:

4                 selecting the maximum loaded sub-channel based on a predefined selection  
5                 scheme.

1           18.     A transceiver for identifying a bitloading assignment for a multicarrier  
2 communication channel having a number of sub-channels and a disposable bit capacity of  
3 one or more bits, the transceiver comprising:

4                 a bitloading assignment module for equalizing bit loadings of the sub-channels  
5                         by selectively decrementing high bitload sub-channels until the  
6                         disposable bit capacity is zero thereby producing a bitloading  
7                         assignment for the multicarrier communication channel.

1           19.     The transceiver of claim 18, further comprising:

2                 a symbol decision and symbol-to-bit decoder module operatively coupled to  
3                         the bitloading assignment module and for deriving a maximum capacity  
4                         assignment from a bitmap that characterizes the multicarrier  
5                         communication channel.

1           20.     The transceiver of claim 18, wherein the high bitload sub-channels are  
2 decremented by a number of bits depending on at least one of the number of sub-channels  
3 of the multicarrier communication channel, the disposable bit capacity of the multicarrier

4 communication channel, and a bitmap associated with the multicarrier communication  
5 channel.

1 21. The transceiver of claim 18, wherein the high bitload sub-channels are  
2 decremented one bit at a time.

1 22. The transceiver of claim 18, wherein the disposable bit capacity cannot be  
2 below zero as a result of decrementing high bitload sub-channels.

1 23. The transceiver of claim 18, wherein the bitloading assignment is  
2 enhanced in that it desensitizes the multicarrier communication channel to non-stationary  
3 noise.

1 24. The transceiver of claim 18, wherein the multicarrier communication  
2 channel is effectively two different channels, one being a FEXT time channel and the  
3 other being a NEXT time channel, each effective channel having a unique maximum  
4 capacity assignment upon which the bitloading assignment module operates thereby  
5 producing a first bitloading assignment for the FEXT channel and a second bitloading  
6 assignment for the NEXT channel.

1 25. The transceiver of claim 18, wherein the bitloading assignment is in the  
2 form of a bit vector upon which the bitloading assignment module operates.

1 26. The transceiver of claim 18, wherein the bitloading assignment module  
2 selects a high bitload sub-channel for decrementing based on a predefined selection  
3 scheme.

1 27. A method for identifying a bitloading assignment for an ADSL Annex C  
2 multicarrier communication channel having a number of sub-channels, a maximum  
3 capacity assignment, and a disposable bit capacity of one or more bits, the method  
4 comprising:

5 identifying a sub-channel having a maximum bit loading relative to bit  
6 loadings of other sub-channels;

7 decrementing the bit loading of the identified sub-channel by at least one bit  
8 thereby reducing bit loading differences between the identified sub-  
9 channel and the other sub-channels;  
10 decrementing the disposable bit capacity by the number of bits the identified  
11 sub-channel loading was decremented; and  
12 repeating the identifying step and the decrementing steps until the disposable  
13 bit capacity is zero thereby producing a bitloading assignment that  
14 desensitizes the ADSL Annex C multicarrier communication channel to  
15 non-stationary noise.

1 28. A method for identifying a bitloading assignment for an ADSL Annex C  
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an  
3 overall target bit capacity, the method comprising:

4 equalizing bits allocated to the FEXT channel and the NEXT channel until the  
5 overall target bit capacity is achieved thereby identifying a target bit  
6 capacity for the FEXT channel and a target bit capacity for the NEXT  
7 channel;

8 equalizing bits allocated to sub-channels included in the FEXT channel by:

9 identifying a sub-channel having a maximum bit loading relative to bit  
10 loadings of other sub-channels of the FEXT channel;

11 decrementing the bit loading of the identified sub-channel by at least  
12 one bit thereby reducing bit loading differences between the  
13 identified sub-channel and the other sub-channels; and

14 repeating the identifying step and the decrementing steps until the  
15 target bit capacity for the FEXT channel is achieved thereby  
16 producing a bitloading assignment that desensitizes the FEXT  
17 channel to non-stationary noise;

18 equalizing bits allocated to sub-channels included in the NEXT channel by:

19 identifying a sub-channel having a maximum bit loading relative to bit  
20 loadings of other sub-channels of the NEXT channel;

21 decrementing the bit loading of the identified sub-channel by at least  
22 one bit thereby reducing bit loading differences between the  
23 identified sub-channel and the other sub-channels; and  
24 repeating the identifying step and the decrementing steps until the  
25 target bit capacity for the NEXT channel is achieved thereby  
26 producing a bitloading assignment that desensitizes the NEXT  
27 channel to non-stationary noise.

1 29. A transceiver for identifying a bitloading assignment for an ADSL Annex  
2 C multicarrier communication channel having a FEXT channel, a NEXT channel, and an  
3 overall target bit capacity, the transceiver comprising:

4 a bitloading assignment module adapted to equalize bits allocated to the FEXT  
5 channel and the NEXT channel until the overall target bit capacity is  
6 achieved thereby identifying a target bit capacity for the FEXT channel  
7 and a target bit capacity for the NEXT channel, and the bitloading  
8 assignment module further adapted to equalize bits allocated to sub-  
9 channels included in the FEXT channel until the target bit capacity for  
10 the FEXT channel is achieved thereby producing a bitloading  
11 assignment that desensitizes the FEXT channel to non-stationary noise,  
12 and the bitloading assignment module further adapted to equalize bits  
13 allocated to sub-channels included in the NEXT channel until the target  
14 bit capacity for the NEXT channel is achieved thereby producing a  
15 bitloading assignment that desensitizes the NEXT channel to non-  
16 stationary noise.

1 30. A method for identifying a bitloading assignment for an ADSL Annex C  
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an  
3 overall target bit capacity, the method comprising:

4 equalizing bits allocated to the FEXT channel and the NEXT channel until the  
5 overall target bit capacity is achieved thereby identifying a target bit  
6 capacity for the FEXT channel and a target bit capacity for the NEXT  
7 channel.

1           31.     A method for identifying a bitloading assignment for an ADSL Annex C  
2 multicarrier communication channel having a FEXT channel, a NEXT channel, and an  
3 overall target bit capacity, the method comprising:

4           allocating bits between the FEXT channel and the NEXT channel until the  
5           overall target bit capacity is achieved thereby identifying a target bit  
6           capacity for the FEXT channel and a target bit capacity for the NEXT  
7           channel.